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**Plant Cell Physiol • Volume 37 • Issue 5**

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## Molecular and biochemical characterization of three anthocyanin synthetic enzymes from *Gentiana triflora*.

Tanaka Y, Yonekura K, Fukuchi-Mizutani M, Fukui Y, Fujiwara H, Ashikari T, Kusumi T

*Plant Cell Physiol* 1996 Jul 37:5 711-6

### Abstract

Full length cDNA clones of flavonoid 3',5'-hydroxylase, dihydroflavonol 4-reductase and flavonoid 3-glucosyltransferase were cloned from petals of *Gentiana triflora*. Their sequences were homologous to counterparts from other plants. Flavonoid 3',5'-hydroxylase and flavonoid 3-glucosyltransferase were enzymatically characterized by expressing cDNAs in heterologous expression systems.

### MeSH

Alcohol Oxidoreductases, Amino Acid Sequence, Anthocyanins, Base Sequence, Cytochrome P-450, DNA, Complementary DNA, Plant, Gene Expression, Glucosyltransferases, Hydroxylases, Molecular Sequence Data, Plant Proteins, Plants, Recombinant Fusion Proteins

### Author Address

Institute for Fundamental Research, Suntory Ltd., Osaka, Japan.

### Secondary Source (links)

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NCBI **BLAST Search Results** BLAST Entrez ?

BLASTN 2.0.10 [Aug-26-1999]

**Reference:**

Altschul, Stephen F., Thomas L. Madden, Alejandro A. Schäffer, Jinghui Zhang, Zheng Zhang, Webb Miller, and David J. Lipman (1997), "Gapped BLAST and PSI-BLAST: a new generation of protein database search programs", Nucleic Acids Res. 25:3389-3402.

**Query=**

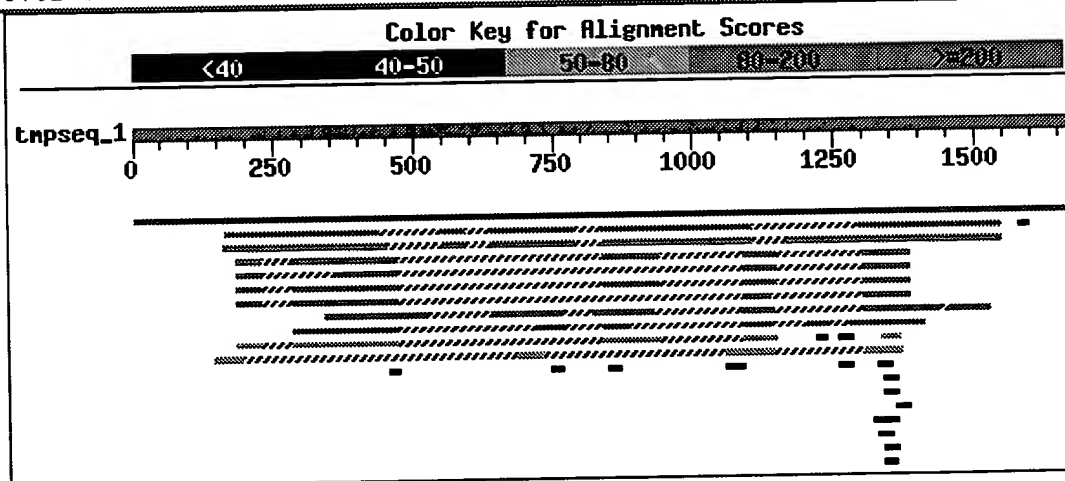
(1666 letters)

**Database:** Non-redundant GenBank+EMBL+DDBJ+PDB sequences  
514,787 sequences; 1,478,834,046 total letters

If you have any problems or questions with the results of this search please refer to the [BLAST FAQs](#)

### Distribution of 66 Blast Hits on the Query Sequence

Mouse-over to show defline and scores. Click to show alignments



Sequences producing significant alignments:

	Score (bits)	E Value
dbj D85184 D85184 Gentiana triflora mRNA for flavonoid 3',5...	3303	0.0
gb U72654 EGU72654 Eustoma grandiflorum flavonoid 3'5'-hydr...	155	5e-35
dbj D14589.1 D14589 Eustoma russellianum mRNA for flavonoid...	147	1e-32
gb AF081575 AF081575 Petunia x hybrida flavonoid 3',5'-hydr...	127	1e-26
emb Z22545 PHFLAHYDB P.hybrida flavonoid 3',5'-hydroxylase ...	127	1e-26
dbj D14588.1 PETHF1 Petunia hybrida Hf1 mRNA for flavonoid...	127	1e-26
emb Z22544 PHFLAHYDA P.hybrida flavonoid 3',5'-hydroxylase ...	111	7e-22
emb AJ011862.1 CRO011862 Catharanthus roseus mRNA for flavo...	103	2e-19
emb X70824 SMPEG1 S.melongena pEG1 mRNA for hydroxylase P45...	100	2e-18
emb X71130 PHPET1 P.hybrida mRNA for P450 hydroxylase	74	1e-10
dbj D14590 D14590 Campanula medium mRNA for flavonoid 3',5'...	72	6e-10
emb X71658 SMCYPEG8 S.melongena CYP76A1 mRNA	52	5e-04
gb AF022459 AF022459 Glycine max cytochrome P450 monooxygen...	46	0.032

<u>emb Y10098 HTCYP76B1</u>	H.tuberosus mRNA for 7-ethoxycoumarin ...	44	0.13
<u>emb Y09920 HT7ECODET</u>	Helianthus tuberosus mRNA for 7-ethoxy...	44	0.13
<u>emb AJ009737 BVU9737</u>	Beta vulgaris mRNA for eukaryotic tran...	42	0.50
<u>gb AC008075.2 F24J5</u>	Arabidopsis thaliana chromosome 1 BAC F...	40	2.0
<u>gb AF124816.1 AF124816</u>	Mentha x piperita cytochrome p450 is...	40	2.0
<u>gb AF135485.1 AF135485</u>	Glycine max cytochrome P450 monooxyg...	40	2.0
<u>emb Y10490 GMC450CP3</u>	G.max mRNA for putative cytochrome P45...	40	2.0
<u>gb AC003685 AC003685</u>	Homo sapiens Xp22 BAC GS-542M4 (Genome...	40	2.0
<u>gb AC004114.1 AC004114</u>	Drosophila melanogaster, chromosome ...	40	2.0
<u>emb AJ000751 CJAJ751</u>	Campylobacter jejuni nifR3 gene, partial	40	2.0
<u>gb AF000403 AF000403</u>	Lotus japonicus putative cytochorome P...	40	2.0
<u>emb Y11368 ZMCYTP450</u>	Z.mays cyp71c4 gene	40	2.0
<u>emb X71657 SMCYPEG7</u>	S.melongena CYP76A2 mRNA for hydroxylase	40	2.0
<u>emb X70981 SMCYPEG2</u>	S.melongena CYP71A1 mRNA for P450 hydro...	40	2.0
<u>emb X81831 ZMCYP71C4</u>	Z.mays CYP71C4 mRNA for cytochrome P-450	40	2.0

dbj|D85184|D85184 Gentiana triflora mRNA for flavonoid 3',5'-hydroxylase, comple  
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Score = 3303 bits (1666), Expect = 0.0

Identities = 1666/1666 (100%)

Strand = Plus / Plus

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L1 186125 AROMATIC

=> s acyl

L2 117328 ACYL

=> s enzyme

L3 1448080 ENZYME

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L4 236 L1 AND L2 AND L3

=> s plant

L5 1147055 PLANT

=> s l4 and l5

L6 9 L4 AND L5

=> d 16 1-9

L6 ANSWER 1 OF 9 BIOSIS COPYRIGHT 2000 BIOSIS  
AN 1999:153961 BIOSIS  
DN PREV199900153961  
TI cDNA cloning, gene expression and subcellular localization of anthocyanin  
5-**aromatic** acyltransferase from *Gentiana triflora*.  
AU Fujiwara, Hiroyuki; Tanaka, Yoshikazu (1); Yonekura-Sakakibara, Keiko;  
Fukuchi-Mizutani, Masako; Nakao, Masahiro; Fukui, Yuko; Yamaguchi,  
Masaatsu; Ashikari, Toshihiko; Kusumi, Takaaki  
CS (1) Inst. Fundamental Res., Suntory Ltd., Wakayamadai 1-1-1,  
Shimamoto-cho, Mishima-gun, Osaka 618-8503 Japan  
SO Plant Journal, (Nov., 1998) Vol. 16, No. 4, pp. 421-431.  
ISSN: 0960-7412.  
DT Article  
LA English

L6 ANSWER 2 OF 9 BIOSIS COPYRIGHT 2000 BIOSIS  
AN 1997:398363 BIOSIS  
DN PREV199799697566  
TI A gallotannin degrading esterase from leaves of pedunculate oak.  
AU Niehaus, Joerg U.; Gross, Georg G. (1)  
CS (1) Univ. Ulm, Abteilung Allgemeine Botanik, D-89069 Ulm Germany  
SO Phytochemistry (Oxford), (1997) Vol. 45, No. 8, pp. 1555-1560.  
ISSN: 0031-9422.  
DT Article  
LA English

L6 ANSWER 3 OF 9 AGRICOLA  
AN 1999:30037 AGRICOLA  
DN IND21974230  
TI cDNA cloning, gene expression and subcellular localization of anthocyanin  
5-**aromatic** acyltransferase from *Gentiana triflora*.  
AU Fujiwara, H.; Tanaka, Y.; Yonekura-Sakakibara, K.; Fukuchi-Mizutani, M.;

.CS Nakao, M.; Fukui, Y.; Yamaguchi, M.; Ashikari, T.; Kusumi, T.  
 AV Suntory, Ltd., Osaka, Japan.  
 SO DNAL (QK710.P68)  
 No. The Plant journal : for cell and molecular biology, Nov 1998. Vol. 16,  
 4. p. 421-431  
 Publisher: Oxford : Blackwell Sciences Ltd.  
 ISSN: 0960-7412  
 NTE Includes references  
 CY England; United Kingdom  
 DT Article  
 FS Non-U.S. Imprint other than FAO  
 LA English

L6 ANSWER 4 OF 9 AGRICOLA  
 AN 1998:4890 AGRICOLA  
 DN IND20607818  
 TI A gallotannin degrading esterase from leaves of pedunculate oak.  
 AU Niehaus, J.U.; Gross, G.G.  
 CS Universitat Ulm, Ulm, Germany.  
 SO Phytochemistry, Aug 1997. Vol. 45, No. 8. p. 1555-1560  
 Publisher: Oxford : Elsevier Science Ltd.  
 CODEN: PYTCAS; ISSN: 0031-9422  
 NTE Includes references  
 CY England; United Kingdom  
 DT Article  
 FS Non-U.S. Imprint other than FAO  
 LA English

L6 ANSWER 5 OF 9 MEDLINE  
 AN 1999097837 MEDLINE  
 DN 99097837  
 TI cDNA cloning, gene expression and subcellular localization of anthocyanin  
 5-**aromatic** acyltransferase from *Gentiana triflora*.  
 AU Fujiwara H; Tanaka Y; Yonekura-Sakakibara K; Fukuchi-Mizutani M; Nakao M;  
 Fukui Y; Yamaguchi M; Ashikari T; Kusumi T  
 CS Institute for Fundamental Research, Suntory Ltd, Osaka, Japan.  
 SO PLANT JOURNAL, (1998 Nov) 16 (4) 421-31.  
 Journal code: BRU. ISSN: 0960-7412.  
 CY ENGLAND: United Kingdom  
 DT Journal; Article; (JOURNAL ARTICLE)  
 LA English  
 FS Priority Journals  
 OS GENBANK-AB010708  
 EM 199903  
 EW 19990305

L6 ANSWER 6 OF 9 MEDLINE  
 AN 1998088004 MEDLINE  
 DN 98088004  
 TI Characterization and heterologous expression of hydroxycinnamoyl/benzoyl-  
 CoA:anthranilate N-hydroxycinnamoyl/benzoyltransferase from elicited cell  
 cultures of carnation, *Dianthus caryophyllus* L.  
 AU Yang Q; Reinhard K; Schiltz E; Matern U  
 CS Institut fur Biologie II, Lehrstuhl fur Biochemie der Pflanzen,  
 Universitat Freiburg, Germany.  
 SO PLANT MOLECULAR BIOLOGY, (1997 Dec) 35 (6) 777-89.  
 Journal code: A6O. ISSN: 0167-4412.  
 CY Netherlands  
 DT Journal; Article; (JOURNAL ARTICLE)  
 LA English  
 FS Priority Journals  
 OS GENBANK-Z84383; GENBANK-Z84384; GENBANK-Z84385; GENBANK-Z84386;  
 GENBANK-Z84571  
 EM 199803  
 EW 19980305



L6 ANSWER 7 OF 9 MEDLINE  
 AN 93251942 MEDLINE  
 DN 93251942  
 TI Genes for polyketide secondary metabolic pathways in microorganisms and plants.  
 AU Hopwood D A; Khosla C  
 CS John Innes Institute, John Innes Centre, Norwich, UK..  
 NC GM39784 (NIGMS)  
 SO CIBA FOUNDATION SYMPOSIUM, (1992) 171 88-106; discussion 106-12. Ref: 37  
 Journal code: D7X. ISSN: 0300-5208.  
 CY Netherlands  
 DT Journal; Article; (JOURNAL ARTICLE)  
 General Review; (REVIEW)  
 (REVIEW, TUTORIAL)  
 LA English  
 FS Priority Journals  
 EM 199308

L6 ANSWER 8 OF 9 CAPLUS COPYRIGHT 2000 ACS  
 AN 1999:20339 CAPLUS  
 DN 130:248677  
 TI cDNA cloning, gene expression and subcellular localization of anthocyanin 5-aromatic acyltransferase from Gentiana triflora  
 AU Fujiwara, Hiroyuki; Tanaka, Yoshikazu; Yonekura-Sakakibara, Keiko; Fukuchi-Mizutani, Masako; Nakao, Masahiro; Fukui, Yuko; Yamaguchi, Masaatsu; Ashikari, Toshihiko; Kusumi, Takaaki  
 CS Institute for Fundamental Research, Suntory Ltd, Osaka, 618-8503, Japan  
 SO Plant J. (1998), 16(4), 421-431  
 CODEN: PLJUED; ISSN: 0960-7412  
 PB Blackwell Science Ltd.  
 DT Journal  
 LA English

L6 ANSWER 9 OF 9 CAPLUS COPYRIGHT 2000 ACS  
 AN 1996:607581 CAPLUS  
 DN 125:270823  
 TI Cloning of cDNA for aromatic acyl transferase of plants for flower breeding  
 IN Ashikari, Toshihiko; Tanaka, Yoshikazu; Fujiwara, Hiroyuki; Nakao, Masahiro; Fukui, Yuuko; Yonekura, Keiko; Mizutani, Masako; Kusumi, Takaaki  
 PA Suntory Limited, Japan  
 SO PCT Int. Appl., 93 pp.  
 CODEN: PIXXD2  
 DT Patent  
 LA Japanese  
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 9625500	A1	19960822	WO 1996-JP348	19960216
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	RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
	JP 09070290	A2	19970318	JP 1996-46534	19960130
	CA 2213082	AA	19960822	CA 1996-2213082	19960216
	AU 9646761	A1	19960904	AU 1996-46761	19960216
	AU 701065	B2	19990121		
	EP 810287	A1	19971203	EP 1996-902462	19960216
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IE					
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	JP 1995-196915		19950629		
	JP 1996-46534		19960130		
	WO 1996-JP348		19960216		

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- L11 ANSWER 1 OF 23 AGRICOLA  
AN 1998:53856 AGRICOLA  
DN IND20631461  
TI Intron sequences are involved in the plastid- and **light-dependent** expression of the spinach Psad gene.  
AU Bolle, C.; Herrmann, R.G.; Oelmüller, R.  
AV DNAL (QK710.P68)  
SO The Plant journal : for cell and molecular biology, Nov 1996. Vol. 10, No. 5. p. 919-924  
Publisher: Oxford : BIOS Scientific Publishers Ltd and Blackwell Sciences Ltd.  
ISSN: 0960-7412  
NTE Includes references  
CY England; United Kingdom  
DT Article  
FS Non-U.S. Imprint other than FAO  
LA English
- L11 ANSWER 2 OF 23 AGRICOLA  
AN 1998:923 AGRICOLA  
DN IND20607051  
TI Reduction of uroporphyrinogen decarboxylase by antisense RNA expression affects activities of other enzymes involved in tetrapyrrole biosynthesis and leads to **light-dependent** necrosis.  
AU Mock, H.P.; Grimm, B.  
CS Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben, Germany.  
SO Plant physiology, Apr 1997. Vol. 113, No. 4. p. 1101-1112  
Publisher: Rockville, MD : American Society of Plant Physiologists, 1926-CODEN: PLPHAY; ISSN: 0032-0889  
NTE Includes references  
CY Maryland; United States  
DT Article; Conference  
FS U.S. Imprints not USDA, Experiment or Extension  
LA English
- L11 ANSWER 3 OF 23 AGRICOLA  
AN 97:66899 AGRICOLA  
DN IND20589775  
TI Cinnamate-4-hydroxylase expression in Arabidopsis regulation in response to development and the environment.  
AU Bell-Lelong, D.A.; Cusumano, J.C.; Meyer, K.; Chapple, C.  
CS Purdue University, West Lafayette, IN.  
SO Plant physiology, Mar 1997. Vol. 113, No. 3. p. 729-738  
Publisher: Rockville, MD : American Society of Plant Physiologists, 1926-CODEN: PLPHAY; ISSN: 0032-0889  
NTE Includes references  
CY Maryland; United States  
DT Article; Conference  
FS U.S. Imprints not USDA, Experiment or Extension  
LA English
- L11 ANSWER 4 OF 23 AGRICOLA  
AN 97:33503 AGRICOLA  
DN IND20564409  
TI Low temperature induces the accumulation of phenylalanine ammonia-lyase and chalcone synthase mRNAs of Arabidopsis thaliana in a **light-**

- dependent manner.**
- AU Leyva, A.; Jarillo, J.A.; Salinas, J.; Martinez-Zapater, J.M.  
 CS Instituto Nacional de Investigacion y Tecnologia Agraria y Alimentaria,  
 Madrid, Spain.  
 AV DNAL (450 P692)  
 SO ~~Plant physiology~~, May 1995. Vol. 108, No. 1. p. 39-46  
 Publisher: Rockville, MD : American Society of Plant Physiologists, 1926-  
 CODEN: PLPHAY; ISSN: 0032-0889  
 NTE Includes references  
 CY Maryland; United States  
 DT Article; Conference  
 FS U.S. Imprints not USDA, Experiment or Extension  
 LA English
- L11 ANSWER 5 OF 23 AGRICOLA  
 AN 95:67510 AGRICOLA  
 DN IND20487137  
 TI Light-responsive and transcription-enhancing elements regulate the  
 plastid  
 psbD core **promoter**.  
 AU Allison, L.A.; Maliga, P.  
 CS The State University of New Jersey, Piscataway, NJ.  
 AV DNAL (QH506.E46)  
 SO The EMBO journal, Aug 1, 1995. Vol. Vol. 14, No. 15. p. 3721-3730  
 Publisher: Oxford, U.K. : Oxford University Press.  
 CODEN: EMJODG; ISSN: 0261-4189  
 NTE Includes references  
 CY England; United Kingdom  
 DT Article  
 FS Non-U.S. Imprint other than FAO  
 LA English
- L11 ANSWER 6 OF 23 AGRICOLA  
 AN 95:13290 AGRICOLA  
 DN IND20445219  
 TI Two distinct cis-acting elements are involved in **light-**  
**dependent** activation of the pea elip **promoter**.  
 AU Blecken, J.; Weisshaar, B.; Herzfeld, F.  
 CS Institut fur Botanik der Universitat Hannover, Hannover, Germany  
 AV DNAL (442.8 Z34)  
 SO Molecular & general genetics : MGG, Nov 1, 1994. Vol. 245, No. 3. p.  
 371-379  
 Publisher: Berlin, Germany : Springer Produktions-Gesellschaft.  
 CODEN: MGGEAE; ISSN: 0026-8925  
 NTE Includes references  
 CY Germany  
 DT Article  
 FS Non-U.S. Imprint other than FAO  
 LA English
- L11 ANSWER 7 OF 23 AGRICOLA  
 AN 92:54828 AGRICOLA  
 DN IND92029990  
 TI Overexpression of phytochrome B induces a short hypocotyl phenotype in  
**transgenic** arabidopsis.  
 AU Wagner, D.; Tepperman, J.M.; Quail, P.H.  
 CS University of California, Berkeley, CA  
 AV DNAL (QK725.P532)  
 SO The Plant cell, Dec 1991. Vol. 3, No. 12. p. 1275-1288  
 Publisher: Rockville, Md. : American Society of Plant Physiologists.  
 ISSN: 1040-4651  
 NTE Includes references.  
 DT Article  
 FS U.S. Imprints not USDA, Experiment or Extension  
 LA English

L11 ANSWER 8 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1997:265664 CAPLUS  
 DN 126:328101  
 TI Reduction of uroporphyrinogen decarboxylase by antisense RNA expression affects activities of other enzymes involved in tetrapyrrole biosynthesis and leads to **light-dependent** necrosis  
 AU Mock, Hans-Peter; Grimm, Bernhard  
 CS Institut Pflanzengenetik Kulturpflanzenforschung, Gatersleben, D-06466, Germany  
 SO Plant Physiol. (1997), 113(4), 1101-1112  
 CODEN: PLPHAY; ISSN: 0032-0889  
 PB American Society of Plant Physiologists  
 DT Journal  
 LA English

L11 ANSWER 9 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1997:190125 CAPLUS  
 DN 126:290689  
 TI Cinnamate-4-hydroxylase expression in Arabidopsis. Regulation in response to development and the environment  
 AU Bell-Lelong, Dolly A.; Cusumano, Joanne C.; Meyer, Knut; Chapple, Clint  
 CS Department of Biochemistry, Purdue University, West Lafayette, IN, 47907, USA  
 SO Plant Physiol. (1997), 113(3), 729-738  
 CODEN: PLPHAY; ISSN: 0032-0889  
 PB American Society of Plant Physiologists  
 DT Journal  
 LA English

L11 ANSWER 10 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1997:1442 CAPLUS  
 DN 126:43527  
 TI Intron sequences are involved in the plastid- and **light-dependent** expression of the spinach Psad gene  
 AU Bolle, Cordelia; Herrmann, Reinhold G.; Oelmueller, Ralf  
 CS Botanisches Institut, Ludwig-Maximilians-Universitaet, Munich, 80638, Germany  
 SO Plant J. (1996), 10(5), 919-924  
 CODEN: PLJUED; ISSN: 0960-7412  
 PB Blackwell  
 DT Journal  
 LA English

L11 ANSWER 11 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1996:734852 CAPLUS  
 DN 126:27612  
 TI Evidence that the plastid signal and light operate via the same cis-acting elements in the promoters of nuclear genes for plastid proteins  
 AU Kusnetsov, Victor; Bolle, Cordelia; Luebberstedt, Thomas; Sopory, Sudhir; Herrmann, Reinhold G.; Oelmueller, Ralf  
 CS Botanisches Institut, Ludwig-Maximilians-Universitaet, Munich, D-80638, Germany  
 SO Mol. Gen. Genet. (1996), 252(6), 631-639  
 CODEN: MGGEAE; ISSN: 0026-8925  
 PB Springer  
 DT Journal  
 LA English

L11 ANSWER 12 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1995:567198 CAPLUS  
 DN 122:310830  
 TI Low temperature induces the accumulation of phenylalanine ammonia-lyase and chalcone synthase mRNAs of Arabidopsis thaliana in a **light-**

dependent manner  
 AU Leyva, Antonio; Jarillo, Jose Antonio; Salinas, Julio; Martine-Zapater, Jose Miguel  
 CS Dep. Biologia Molecular Virologia Vegetal, Inst. Nacional Investigacion Tecnologia Agraria Alimentaria, Mardis, 28040, Spain  
 SO Plant Physiol. (1995), 108(1), 39-46  
 CODEN: PLPHAY; ISSN: 0032-0889  
 DT Journal  
 LA English

L11 ANSWER 13 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1995:394210 CAPLUS  
 DN 122:283734  
 TI Two distinct cis-acting elements are involved in **light-dependent** activation of the pea elip **promoter**  
 AU Blecken, Jens; Weisshaar, Bernd; Herzfeld, Frank  
 CS Inst. Botanik, Univ. Hannover, Hannover, 30419, Germany  
 SO Mol. Gen. Genet. (1994), 245(3), 371-9  
 CODEN: MGGEAE; ISSN: 0026-8925  
 DT Journal  
 LA English

L11 ANSWER 14 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1993:666574 CAPLUS  
 DN 119:266574  
 TI Light-regulated expression of the Arabidopsis thaliana ferredoxin A gene involves both transcriptional and post-transcriptional processes  
 AU Vorst, Oscar; van Dam, Frans; Weisbeek, Peter; Smeekens, Sjef  
 CS Dep. Mol. Cell Biol., Univ. Utrecht, Utrecht, 3584 CH, Neth.  
 SO Plant J. (1993), 3(6), 793-803  
 CODEN: PLJUED; ISSN: 0960-7412  
 DT Journal  
 LA English

L11 ANSWER 15 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1993:642538 CAPLUS  
 DN 119:242538  
 TI **Promoter** analysis of a light-regulated gene encoding hydroxypyruvate reductase, an enzyme of the photorespiratory glycolate pathway  
 AU Sloan, James S.; Schwartz, Brian W.; Becker, Wayne M.  
 CS Dep. Genet., Univ. Wisconsin, Madison, WI, 53706, USA  
 SO Plant J. (1993), 3(6), 867-74  
 CODEN: PLJUED; ISSN: 0960-7412  
 DT Journal  
 LA English

L11 ANSWER 16 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1993:249032 CAPLUS  
 DN 118:249032  
 TI Characterization of the **promoter** from the single-copy gene encoding ferredoxin-NADP+-oxidoreductase from spinach  
 AU Oelmueller, R.; Bolle, C.; Tyagi, A. K.; Niekrawietz, N.; Breit, S.; Herrmann, R. G.  
 CS Bot. Inst., Ludwig-Maximilians-Univ., Munich, W-8000/19, Germany  
 SO Mol. Gen. Genet. (1993), 237(1-2), 261-72  
 CODEN: MGGEAE; ISSN: 0026-8925  
 DT Journal  
 LA English

✓ L11 ANSWER 17 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1992:167780 CAPLUS  
 DN 116:167780  
 TI Tissue-specific activity and **light-dependent** regulation of a soybean rbcS **promoter** in **transgenic**

tobacco plants monitored with the firefly luciferase gene  
 AU Quandt, H. J.; Broer, I.; Puehler, A.  
 CS Fak. Biol., Univ. Bielefeld, Bielefeld, D-4800/1, Germany  
 SO Plant Sci. (Limerick, Irel.) (1992), 82(1), 59-70  
 CODEN: PLSCE4; ISSN: 0168-9452  
 DT Journal  
 LA English

L11 ANSWER 18 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1992:167682 CAPLUS  
 DN 116:167682  
 TI Unusual features of the light response system regulating ferredoxin gene expression  
 AU Thompson, W. F.; Elliott, R. C.; Dickey, L. F.; Gallo, M.; Pedersen, T. J.; Sowinski, D. A.  
 CS Dep. Bot., North Carolina State Univ., Raleigh, NC, 27695, USA  
 SO NATO ASI Ser., Ser. H (1991), 50(Phytochrome Prop. Biol. Action), 201-16  
 CODEN: NASBE4; ISSN: 1010-8793  
 DT Journal  
 LA English

L11 ANSWER 19 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1992:102785 CAPLUS  
 DN 116:102785  
 TI Overexpression of phytochrome B induces a short hypocotyl phenotype in **transgenic** Arabidopsis  
 AU Wagner, Doris; Tepperman, James M.; Quail, Peter H.  
 CS Dep. Plant Biol., Univ. California, Berkeley, CA, 94720, USA  
 SO Plant Cell (1991), 3(12), 1275-88  
 CODEN: PLCEEW; ISSN: 1040-4651  
 DT Journal  
 LA English

L11 ANSWER 20 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1990:510450 CAPLUS  
 DN 113:110450  
 TI Minimal sequence requirements for the regulated expression of rbcS-3A from **Pisum sativum** in **transgenic** tobacco plants  
 AU Cuzzo-Davis, Maria; Yong, Mun Heng; Gilmartin, Philip M.; Goyvaerts, Elisabeth; Kuhlemeier, Cris; Sarokin, Laura; Chua, Nam Hai  
 CS Lab. Plant Mol. Biol., Rockefeller Univ., New York, NY, 10021-6399, USA  
 SO Photochem. Photobiol. (1990), 52(1), 43-50  
 CODEN: PHCBAP; ISSN: 0031-8655  
 DT Journal  
 LA English

L11 ANSWER 21 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1990:435683 CAPLUS  
 DN 113:35683  
 TI GT-1 binding site confers light responsive expression in **transgenic** tobacco  
 AU Lam, Eric; Chua, Nam Hai  
 CS Lab. Plant Mol. Biol., Rockefeller Univ., New York, NY, 10021, USA  
 SO Science (Washington, D. C., 1883-) (1990), 248(4954), 471-4  
 CODEN: SCIEAS; ISSN: 0036-8075  
 DT Journal  
 LA English

L11 ANSWER 22 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1990:1903 CAPLUS  
 DN 112:1903  
 TI cis-Acting elements for light regulation of pea ferredoxin I gene expression are located within transcribed sequences  
 AU Elliott, Robert C.; Dickey, Lynn F.; White, Michael J.; Thompson, William

Quandt et al.  
 Rutge et al.  
 Ieyva et al.

F.  
 CS Dep. Bot., North Carolina State Univ., Raleigh, NC, 27695, USA  
 SO Plant Cell (1989), 1(7), 691-8  
 CODEN: PLCEEW; ISSN: 1040-4651  
 DT Journal  
 LA English

L11 ANSWER 23 OF 23 CAPLUS COPYRIGHT 1999 ACS  
 AN 1989:109305 CAPLUS  
 DN 110:109305  
 TI Dissection of 5' upstream sequences for selective expression of the  
 Nicotiana plumbaginifolia rbcS-8B gene  
 AU Poulsen, Carsten; Chua, Nam Hai  
 CS Lab. Plant Mol. Biol., Rockefeller Univ., New York, NY, 10021-6399, USA  
 SO MGG, Mol. Gen. Genet. (1988), 214(1), 16-23  
 CODEN: MGGEAE; ISSN: 0026-8925  
 DT Journal  
 LA English

=> d 111 1 4 5 6 21 17 abs

L11 ANSWER 1 OF 23 AGRICOLA  
 AB Plastid- and light-regulated expression of the spinach Psad gene in **transgenic** tobacco requires sequences down-stream of the transcription start site, and **promoter** sequences alone are not sufficient to respond to these stimuli. The spinach Psad mRNA level in **transgenic** tobacco is still plastid- and light-responsive when the expression of the intron-containing transcription unit is driven by the 35S RNA CaMV **promoter** indicating that Psad contains (a) gene-internal control element(s). If the genomic Psad sequence in the latter construct was replaced by the cDNA, a constitutive expression of the Psad transcript level was observed. It is concluded that the intron sequence contributes to the plastid- and **light-dependent** expression of the spinach Psad gene.

L11 ANSWER 4 OF 23 AGRICOLA  
 AB Anthocyanins, which accumulate in leaves and stems in response to low temperature and changes in light intensity, are synthesized through the phenylpropanoid pathway that is controlled by key enzymes that include phenylalanine ammonia-lyase (PAL) and chalcone synthase (CHS). In this work we demonstrate that PAL and CHS mRNAs accumulate in leaves of Arabidopsis thaliana (L.) Heynh. upon exposure to low temperature in a **light-dependent** manner. The regulation of the PAL1 gene expression by low temperature and light was examined by analyzing the expression of the beta-glucuronidase (uidA) reporter gene in **transgenic** Arabidopsis plants containing the uidA gene of Escherichia coli under the control of the PAL1 **promoter**. The results indicate that the accumulation of PAL1 mRNA is transcriptionally regulated. Histochemical staining for beta-glucuronidase activity showed that the PAL1 **promoter** is preferentially activated in photosynthetically active cells, paralleling anthocyanin accumulation. Moreover, we show that light may also be implicated in the regulation of the CHS gene in response to bacterial infiltration. Finally, using two transparent testa Arabidopsis mutants that are unable to accumulate anthocyanins, we demonstrate that these pigments are not required for successful development of freezing tolerance in this species.

L11 ANSWER 5 OF 23 AGRICOLA  
 AB The psbD operon of higher **plant** plastids is regulated transcriptionally through the activity of an upstream light-responsive **promoter**. To identify **promoter** elements important for the regulation, portions of the tobacco psbD 5' region were fused to the reporter gene, uidA, and were introduced into the tobacco plastid genome by targeted gene insertion. Examination of uidA mRNA accumulation in

dark-adapted and light-treated transplastomic plants revealed that a 107 bp segment of psbD 5' sequence was sufficient to promote light-responsive expression of the reporter gene in vivo. The 107 bp **promoter** region contains three pairs of short, repeated sequences upstream of the core **promoter** -10/-35 elements. Deletion of the upstream-most A-rich sequences resulted in a 5-fold decrease in reporter gene mRNA accumulation, but did not affect the light response. Additional removal

of

the second and third repeated elements further reduced the **promoter** strength approximately 30-fold and almost eliminated the **light-dependent** accumulation of uidA transcripts. These data indicate that the architecture of chloroplast promoters is more complex than previously assumed, and may comprise general enhancer and regulatory elements in addition to the core **promoter** motifs. Transcriptional regulation of psbD may be mediated by the chloroplast proteins which were shown to interact with the repeated sequences.

L11 ANSWER 6 OF 23 AGRICOLA

AB Light activation of the pea (*Pisum sativum*) elip gene **promoter** was analysed in **transgenic** plants and in transiently transfected **plant** protoplasts. A series of **promoter** deletions fused to the gusA reporter was tested, and the results obtained by the two experimental approaches were in good agreement. We identified two nucleotide sequence elements involved in light-regulated expression of

the

elip gene. One element is similar to the GTI binding site of the rbcS-3A gene, and the other resembles a G-box-like ACGT element. The region containing both elements was able to confer light responsiveness on a heterologous basic **promoter**. Electrophoretic mobility shift assays demonstrated that each element is specifically recognized by DNA-binding proteins present in nuclear extracts from pea seedlings. The G-box-like ACGT element is necessary but not sufficient for light inducibility, indicating that the two elements act together in conferring light responsiveness.

L11 ANSWER 21 OF 23 CAPLUS COPYRIGHT 1999 ACS

AB **Light-dependent** expression of rbcS, the gene encoding the small subunit of ribulose-1,5-bisphosphate carboxylase, which is the key enzyme involved in carbon fixation in higher plants, is regulated at the transcriptional level. Sequence anal. of the gene has uncovered a conserved GT motif in the -150 to -100 region of many rbcS promoters. This motif serves as the binding site of a nuclear factor, designated GT-1. Anal. of site-specific mutants of pea rbcS-3A **promoter** demonstrated that GT-1 binding in vitro is correlated with light-responsive expression of the rbcS **promoter** in **transgenic** plants. However, it is not known whether factors other than GT-1 might also be required for activation of transcription by

light.

A synthetic tetramer of box II (TGTGTGGTTAATATG), the GT-1 binding site located between -152 to -138 of the rbcS-3A **promoter**, inserted upstream of a truncated cauliflower mosaic virus 35S **promoter** is sufficient to confer expression in leaves of **transgenic** tobacco. This expression occurs principally in chloroplast-contg. cells, is

induced

by light, and is correlated with the ability of box II to bind GT-1 in vitro. The data show that the binding site for GT-1 is likely to be a part of the mol. light switch for rbcS activation.

L11 ANSWER 17 OF 23 CAPLUS COPYRIGHT 1999 ACS

AB The spatial and temporal **promoter** activity of the soybean rbcS gene SRS1 in **transgenic** tobacco plants was investigated. A 5'-fragment of the gene was fused to the coding region of the North American firefly luciferase (luc), to function as a reporter gene. The hybrid gene was introduced into *Nicotiana tabacum* by *Agrobacterium*-mediated leaf disk transformation and **transgenic** plants were



regenerated. In planta and in vitro luciferase assays demonstrated that the activity of the soybean rbcS **promoter** in the heterologous tobacco background not only remained organ-specific, but was also stimulated by light. This is the first report demonstrating the suitability of the firefly luciferase reporter gene to investigate the temporal expression pattern of an environmentally-stimulated **plant**